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Tracheostomy experiences in an adult anesthesia intensive care unit

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Abstract

Aim: This study aimed to present the tracheostomy procedures in patients treated in the adult anesthesia intensive care unit (ICU) of our clinic.

Material and Methods: Patients who admitted to the adult anesthesia ICU of our hospital and underwent surgical and percutaneous tracheostomy between January 2012 and January 2019 were retrospectively evaluated. The demographic data of the patients, diagnosis upon ICU hospitalization, Glasgow coma scale score, acute physiological and chronic health assessment results, length of stay with tracheostomy, duration of tracheostomy procedure, method of tracheostomy (percutaneous or surgical), complications, and mortality rates were investigated.

Results: The data of 114 patients were analyzed. Among patients with a mean age of 72.03 ± 14.12 years, 41.23% were females, and 58.77% were males. At ICU admissions, the most common diagnoses were pulmonary pathologies in 29.82%, cardiovascular diseases in 25.44%, and cerebral pathologies in 20.18%. The mean length of stay of the patients after the tracheostomy procedure was 17.09±7.22 days. Seventy-two (63.16%) patients underwent percutaneous tracheostomy, and 42 (36.84%) underwent surgical tracheostomy. The mean tracheostomy procedure duration was 12.82±8.04 minutes; 19 (16.67%) patients had complications, mostly bleeding. The overall mortality rate was 25.44%, most seen among the patients with cardiovascular diseases (81.82%). Of the tracheostomized patients, 53.51% were transferred to palliative care and other services, and 21.05% were discharged as home care patients.

Discussion: The tracheostomy procedure is crucial in the transfer or discharge of patients hospitalized in the adult intensive care unit with home-type mechanical ventilators or spontaneous breathing.

Keywords

Tracheostomy, Intensive Care Unit, Patient, Complication

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Introduction

For the continuation of artificial respiration and maintenance of airway patency, endotracheal intubation is currently the first option in ICUs today. When the clinical course of inpatients in the ICU improves, the patient can be extubated. However, some patients may require artificial respiratory support for several weeks and sometimes months. The recommendation to perform tracheostomy as an alternative to intubation in patients who underwent intubation and are expected to need prolonged mechanical ventilation has taken its place in the literature. The complications of long-lasting endotracheal intubation have been investigated, and the necessity of a tracheostomy has been revealed. Tracheostomy is performed to reduce complications of long-term endotracheal intubation, including vocal cord paralysis, glottic or subglottic stenosis, laryngeal damage and infection [1]. Protecting the airway in patients in the ICU, easy cleaning of tracheal secretions, reducing the dead space volume, shortening the length of stay in ICU, facilitating oral feeding, increasing patient comfort are among the other reasons for performing a tracheostomy [2]. The tracheostomy procedure has been a lifesaver in upper airway obstructions due to trauma, foreign body aspiration, and infections for a long time in human history. References indicate that the first tracheostomy was performed in the 100th year BC by Greek doctor Asclepiades. Jackson first performed the standard surgical tracheostomy in 1909, and the first modern percutaneous tracheostomy was reported by Shelden et al. in 1955. Tracheostomy is performed with two techniques. The percutaneous dilatational tracheostomy technique was developed by Ciaglia et al., and the percutaneous guidewire dilatational tracheotomy technique was developed by Griggs et al. [3]. Tracheostomy is applied by surgical or percutaneous methods today. There are publications in the literature that include comparisons and experiences with tracheostomy [4-7]. This study aimed to retrospectively evaluate the tracheostomies conducted in the adult anesthesiology and reanimation ICU and contribute to the literature with this experience.

Material and Methods

Study Plan and Patient Selection

A total of 114 patients who were hospitalized in the adult ICU and underwent percutaneous or surgical tracheostomy between January 2012 and January 2019 were retrospectively analyzed. The data of the patients were acquired from the hospital data processing system and patient files. The study included patients over 18 years of age who were treated in our anesthesiology ICU and underwent a tracheostomy procedure. Individuals aged ≤ 18 years, whose data were missed, and patients who underwent an emergency tracheostomy procedure were excluded. The demographic data of the patients, ICU admission diagnoses, Glasgow coma scale (GCS) scores at admission to the ICU, acute physiological and chronic health evaluation (APACHE 2), and other relevant data were analyzed. The length of stay with the tracheostomy, duration, and the method of the tracheostomy procedure (percutaneous or surgical) were recorded. Reasons for the preference of the surgical method, the duration of the procedure, and complication rates were compared between the percutaneous and surgical tracheostomy groups. Complications were categorized as early and late, according to whether they occurred during or after the procedure. Bleeding that did not stop within a short time with sponges wrapped around the stoma and/or blood aspiration through the tracheostomy tube were considered minor bleeding. Continued bleeding from the stoma and/or aspiration of blood from the tracheostomy, despite compression were considered major bleeding. Only major bleeding patients were included in the bleeding complication rate calculation. The reasons for the termination of the ICU treatments of the patients (discharged as a home care patient, transfer to the wards, mortality) were investigated. The current respiratory status of the patients (not tracheostomized and spontaneous respiration, tracheostomized and spontaneous respiration, receiving home-type mechanical ventilator support without spontaneous respiration) was documented.

Routine Tracheostomy Procedure

The patients whose consent was obtained for the tracheostomy procedure were monitored with electrocardiography, pulse oximetry, and invasive arterial pressure with (end-tidal carbon dioxide) $EtCO_2$. Before the tracheostomy procedure, the patients were administered fentanyl (2 μg/kg) (Talinate, Ibrahim Etem Pharmaceuticals, Turkey), midazolam (0.1 mg/kg) (Sedazolam, Monemfarma Pharmaceuticals, Turkey), and rocuronium (0.5 mg/kg) (Myocron, Vem Pharmaceuticals, Turkey) intravenously. The patients were supported by positive pressure mechanical ventilation with 100% oxygen. After the endotracheal tube cuff was deflated in the patients who received a percutaneous dilatational tracheostomy, it was retracted until below the vocal cords. The space between the second and third tracheal rings was palpated. After a vertical incision, the tracheal lumen was cannulated with a 14 G needle. A guidewire was placed in the lumen; the needle was withdrawn and expanded with an 8F dilator. The skin, subcutaneous tissue, and the trachea were dilated with forceps, and a tracheostomy tube was placed in the trachea. After the cuff was inflated, respiratory sounds were auscultated, and the cannula location was evaluated. The patients in whom a fiberoptic bronchoscope was used during the procedure were noted. In the patients who underwent surgical tracheostomy, the space between the second and third tracheal rings was palpated, and the skin was incised. The subcutaneous tissue, superficial fascia, platysma muscle, superficial layer of the deep fascia, infrahyoid muscles, visceral fascia, thyroid gland, and pretracheal fascia were dissected to reach the trachea. The endotracheal tube was retracted until below the vocal cords after the cuff was deflated. The cannula was placed in the trachea after incision and aspiration. The endotracheal tube was removed after the cuff was inflated, breathing sounds were auscultated, and the location of the cannula was confirmed. After the procedures, the chest X-rays of the patients were taken at the bedside.

Statistical analysis

The data were analyzed with IBM SPSS 25.0 (Statistic Inc. version Chicago, IL, USA) software. Descriptive statistics were presented as mean ± standard deviation values for continuous variables, and categorical variables were expressed in frequency and percentage (%). The duration of the procedure in the patients who underwent percutaneous and surgical tracheostomy was compared using the independent samples

t-test, while the overall complication rates between these two groups were compared using the chi-square analysis method. Results were considered significant at 95% confidence intervals and at $p < 0.05$.

Results

The data of 114 patients were analyzed. The demographical data of the patients, GCS, APACHE 2 scores, and ICU admission diagnoses are summarized in Table 1.

The mean length of stay in the ICU was 50.03±19.81 days. The mean hospital stay of the patients until the tracheostomy procedure was 17.09±7.22 days. Seventy-two patients (63.16%) underwent percutaneous tracheostomy, and 42 patients (36.84%) underwent surgical tracheostomy. The mean tracheostomy procedure duration was 12.82±8.04 minutes. Among the patients who underwent surgical tracheostomy, 10 (8.77%) were morbidly obese, 9 (7.89%) had a neck mass, 9 (7.89%) underwent a retracheostomy, 6 (5.26%) had anatomical deformations, 5 (4.39%) had early complications related to a percutaneous tracheostomy, and 3 (2.63%) had no specific indications.

Among all patients, 19 (16.67%) had complications, of which 10 (8.77%) had early tracheostomy complications. Four patients (3.51%) had major bleeding, 2 (1.75%) had pneumothorax, 2 (1.75%) had paratracheal cannulas and ventilation leak, 1 (0.88%) had emphysema. Mortality was observed in 1 patient (0.88%) due to the tracheostomy procedure. Late complications were detected in 9 (7.89%) patients. Four patients (3.51%) had tracheal stenosis, 2 (1.75%) had wound infection, 2 (1.75%) had tracheoesophageal fistulae, and 1 (0.88%) had tracheo-innominate artery fistula. The outcomes of the tracheostomy procedures and the respiratory statuses at transfer to another ward or discharge are summarized in Table 2.

The duration of the procedure in the patients who underwent percutaneous and surgical tracheostomy was compared. The mean duration of the procedure was 8.90±5.32 in the percutaneous tracheostomy group, 19.55±7.48 in the surgical tracheostomy group, and the difference was statistically significant ($p<0.05$). A fiberoptic bronchoscope was used in 36 (50%) patients who underwent percutaneous tracheostomy. The overall complication rate in the patients who underwent tracheostomy was 21.93%, while 22.22%, and 21.43% in those who underwent percutaneous and surgical tracheostomy, respectively ($p>0.05$).

The mortality rates were evaluated according to the diagnosis upon ICU hospitalization (Table 3). Accordingly, mortality was observed in 81.82% of the patients hospitalized due to cardiovascular diseases, 40% of the patients with chronic organ failure, 20.69% of those with cerebral pathologies, 17.39% of the patients hospitalized due to surgical complications, and 5.88% of those hospitalized due to pulmonary pathologies. On the other hand, no mortality was observed in the patients hospitalized in the ICU due to neuromuscular diseases and trauma.

Table 1. Demographic Data and Admission Diagnoses of Tracheostomized Patients

	(Mean ± SD)
Age	72.03±14.12
Body Weight (kg)	74.81±15.66
Height (cm)	166.62±8.75
Apache Score	26.32±6.14
Glasgow Coma Score	7.02±3.16
	n (%)
Females	47 (41.23)
Males	67 (58.77)
Pulmonary pathologies	34 (29.82)
Cardiovascular diseases	29 (25.44)
Cerebral pathologies	23 (20.18)
Surgical complications	11 (9.65)
Organ failure	5 (4.39)
Neuromuscular diseases	10 (8.77)
Trauma	2 (1.75)

n: Number, SD: Standard Deviation

Table 2. Procedural Data and Intensive Care Unit Findings of the Tracheostomized Patients

	Mean ± SD
ICU Hospitalization Duration (days)	50.03±19.81
Hospitalization Time Until Tracheostomy Procedure (days)	17.09±7.22
Tracheostomy Procedure Duration (min)	12.82±8.04
	n (%)
Percutaneous tracheostomy	72 (63.16)
Surgical tracheostomy	42 (36.84)
Indications for a Surgical Tracheostomy	
Neck mass	9 (7.89)
Morbid Obesity	10 (8.77)
Retracheostomy	9 (7.89)
Early Complications of Percutaneous Tracheostomy	5 (4.39)
Anatomical Deformation (burn, trauma)	6 (5.26)
No indication	3 (2.63)
Tracheostomized Patient Outcomes	
Transfer from the ICU to Palliative Care and other wards	61 (53.51)
Discharged as a home care patient	24 (21.05)
Mortality	29 (25.44)
Respiratory Status at Discharge or Transfer	
Spontaneous Breathing and Decannulation	12 (10.53)
Spontaneous Breathing Without Decannulation	9 (7.89)
On a Home-type Mechanical Ventilator	64 (56.14)

n: Number, SD: Standard Deviation, ICU: Intensive Care Unit

Table 3. Overall Mortality Rate by Intensive Care Unit Hospitalization Diagnosis

Hospitalization Diagnosis	Number of patients	Mortality Rate n (%)
Pulmonary pathologies	34	2 (5.88)
Cerebral pathologies	29	6 (20.69)
Surgical complications	23	4 (17.39)
Cardiovascular diseases	11	9 (81.82)
Chronic organ failure	5	2 (40)
Neuromuscular diseases	10	-
Trauma	2	-
TOTAL	114	23 (20.18)

n: Number.

Discussion

Tracheostomy is preferred in endotracheal intubation to facilitate weaning and for patients in whom mechanical ventilation support is expected to last long [1,8]. Indications of tracheostomy include weaning failure, difficult airway, prolonged mechanical ventilation need, upper airway obstruction and the presence of excessive, obstructive secretions in the trachea. In addition, patients with acute cerebral injury and/or acute respiratory failure frequently need a tracheostomy. A study reported the hospitalization diagnoses, which were tracheostomy indications as acute respiratory failure (56.5%), chronic obstructive pulmonary (6.2%), and coma (5.1%) [8]. Şeker et al. reported the hospitalization diagnoses for tracheostomy as central nervous system pathologies (29%), polytrauma (21%), intra-abdominal sepsis (17%), respiratory system pathologies (13%), multiple organ failure (10%), and cardiopulmonary resuscitation (2.4%) [9]. While respiratory failure was the most common diagnosis in their first study, in the second study of Şeker et al. central nervous system pathologies were at the forefront. In our study, the most common hospitalization diagnosis was respiratory failure pathologies. In addition, the fact that ours is a branch hospital for cardiological patients also highlights cardiological pathologies in hospitalization, which is a tracheostomy indication (Table 1). Regarding the duration of the tracheostomy procedure, it is difficult to recommend a standard time period according to patient groups and diagnoses. The responsible clinician can make this decision after evaluating the patient and the clinical situation. However, in the presence of pathology (neurological damage, progressive muscle diseases, medulla spinalis injuries, masses causing airway obstruction) that renders extubation difficult within a short time, the best approach would be to perform a tracheostomy as soon as possible after admission to the intensive care unit and intubation. There are studies on the performance time in the ICUs [10,11]. For example, a study in England analyzed the data of 178 cases and found that tracheostomies were performed in the first week of hospitalization in half of the patients, and the second week and later in the other half [10]. In a different study, early and late tracheostomy performance times were evaluated separately. Early tracheostomies were executed in 7.60±4 days and late tracheostomies, in 17.40±5.30 days, with a longer intensive care unit stay in patients who underwent a late tracheostomy [11]. We found that a tracheostomy was performed within 17.09±7.22 days of admission to our ICU, similar to that of the patients who received a late tracheostomy in the aforementioned study (Table 2). The percutaneous technique is preferred for patients hospitalized in the intensive care unit because it can be applied at the bedside, the perioperative and postoperative complication rates are lower, and the procedure time is short. Mirski et al. reported that percutaneous tracheostomy is the most frequently preferred technique and that its use has been increasing gradually over the years (from 46.2% in 2004 to 77.2% in 2008) [12]. In an international multicenter study conducted by Maria et al. in 2015, the rate of percutaneous tracheostomy was higher (63.16%), consistent with the literature [13]. In a study comparing percutaneous and surgical tracheostomy, the durations of the procedures were 6.19±0.54 minutes and 32.07 ± 2.86 minutes, respectively [4]. In another study, the duration of percutaneous dilatational tracheostomy was 12.4 ± 3.2 minutes, and that of surgical tracheostomy was 21.2 ± 2.9 minutes [14]. The results in the literature are similar to the results of our study, and the duration of percutaneous dilatational tracheostomy is shorter than surgical tracheostomy. According to the literature, tracheostomy complications can be classified as early and late complications. While bleeding, pneumothorax, emphysema, paratracheal insertion of the cannula, and cardiac arrest are early complications, tracheo-innominate artery fistula, tracheal stenosis, tracheoesophageal fistula and wound infections are late complications [15,16]. Cırık et al. investigated the results of percutaneous tracheostomy in 96 patients and found an early complication rate of 17.7 %. They stated that the most common complication was bleeding in 11 (%11.4) patients [17]. In a meta-analysis, bleeding and stoma infection were reported to be more common in patients who underwent surgical tracheostomy [18]. Incorrect and difficult placement of the tracheostomy cannula, hypoxia, loss of airway control, and related death were higher in percutaneous tracheostomy In a retrospective study of 115 patients who underwent percutaneous tracheostomy with the Griggs method, the early complications were minor bleeding, surgical bleeding, and incorrect cannula placement with the rates of 2.6%, 0.86%, and 0.86%, respectively [19]. In the study by Demirel et al. 52 patients with tracheostomy were evaluated, 5 patients had early complications (9.6%), and bleeding was the most common [20]. In another study by Düger et al., it was concluded that the percutaneous tracheostomy method gave better results than the surgical tracheostomy method in terms of oxygenation, complications and bleeding in the early postoperative period, and that many factors such as the urgency of the tracheostomy and the experience of the person and the clinic affected the complication rate [21]. Bleeding, pneumothorax, emphysema, paratracheal cannula placement, and cardiopulmonary arrest due to ventilation leak were the early complications among our ICU patients. The most common complication was bleeding, whereas tracheal stenosis was the most common late complication. Other late complications included tracheo-innominate artery fistula, wound infection, and tracheoesophageal fistula. During transfer to the ward or at discharge, 12 (10.53%) patients were spontaneously breathing and decannulated, 9 (7.89%) patients were spontaneously breathing without decannulation, and 64 (56.14%) patients were receiving home-type mechanical ventilator support. The remaining 29 (25.44%) patients died. There are various studies investigating the mortality rate among ICU patients who underwent tracheostomy. Diaz et al. reported a 30% mortality rate in the ICU [22]. In the study by Lin et al. on patients who needed mechanical ventilation for more than 14 days, the mortality rate in the ICU was 17% among the tracheostomy patients [23]. The 25.44% mortality rate found in our study is close to the results reported in the literature. ICU admission diagnoses are factors that affect mortality, and the highest mortality rate was 81.82% witnessed in the patients hospitalized in the ICU due to cardiovascular diseases. It is thought that the fact that our hospital is a reference center for cardiovascular diseases affected this result. The limitations of

our study include its retrospective nature and the fact that our hospital was a branch hospital.

Conclusion

The tracheostomy outcomes in our clinic meet international standards in terms of both complications and mortality. The tracheostomy procedure is an important factor in transferring the patient to the ward or discharge with a home-type mechanical ventilator or spontaneously breathing.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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